Brand Color Reproduction Using Expanded Gamut Technology With Offset Printing

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Overview
- Brief History
- Recent developments
- Why did we do this project
- Equipment used
- Test charts
- Ink dry back
- DE comparisons
- Ink composition comparisons
- Color gamut
- Conclusion

Brief History
- Expanded gamut started to be used in 1960 by Hallmark
- Most know systems from the past are Opaltone and Pantone Hexachrome
- Currently under expanded gamut printing the standard ink set of CMYK is expanded through the colors Orange (O), Green (G) and Violet (V).

Recent developments
- O’Hara et al. presented at the 2019 conference their research into expanded gamut printing by reducing the chroma of Orange, Green and Violet (OGV) from 100% to 80% in 10% increments. The main points from the study were:
  - The greatest chroma of the OGV inks does not mean the largest gamut volume
  - The greatest chroma does not mean the most Pantone colors. Low chroma inks can often make more Pantone colors
  - The greatest gamut volume doesn’t mean the most Pantone colors and
  - The ink film thickness appears to influence the gamut size beyond its influence on the chroma of solids

Recent developments
- Hoffstadt talked at the 2019 conference about the ideal number of test patches for EG printing
  - The ideal number of test patches should be between 1,000 and 5,000
  - Idealliance ECG project ➔ test chart for everyone
  - Small chart with 420 patches
  - Large chart with 4340 patches (4 x 1085 patches)
  - Goal: Get a better understanding of the EG printing

Recent developments
- EG printing study conduct by A. Sharma
  - Used a proofer and an HP Indigo 7900
  - Will be expanded into flexographic printing
  - FOGRA studies
Benefits of EG printing

- Ink inventories can be standardized
- Fewer wash-ups of ink trains
- No blanket changes
- Simple plate changes
- Gang run efficiencies

Why did we do this project?

- We wanted to see how selected corporate colors can be reproduced using expanded gamut printing
- Does expanded gamut printing fulfill the promises that it makes?

Equipment used in this study

- Equipment:
  - Heidelberg PM14-4P
  - X-Rite i1iS
  - X-Rite (Six XL, MI)
  - X-Rite i1iS
  - GMG OPENColor V2.2
  - GMG Profiler (V 5.10.1.121)
  - Epson SureColor P9000
  - Kodak ProEnergy & Preps
  - Pantone Color Manager
  - Esko Explosive Profile Creator V14
  - Esko ColorRite v1.4
  - ColorThink

- Materials:
  - Offset inks from Hubergroup Canada
  - Black: 49 RL 2501
  - Cyan: 43 F 10 PX
  - Magenta: 42 F 10 PX
  - Yellow: 41 F 11 PX
  - Orange 2 ONX 51500
  - Green 4 ONX 51502
  - Violet 3 ONX 51501
  - Substrate: Caroline 8pt C1S

Selected Brand Colors

<table>
<thead>
<tr>
<th>Brand</th>
<th>Color</th>
<th>Color</th>
<th>Percentage</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Tally</td>
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<td>Yellow</td>
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<tr>
<td>Yellow</td>
<td>Violet</td>
<td>Yellow</td>
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<td>237</td>
</tr>
<tr>
<td>John Deere</td>
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<td>Yellow</td>
<td>284</td>
<td>169</td>
</tr>
</tbody>
</table>
Processing of the files

- Test charts were processed using Kodak Prinergy workflow
- Screen angles:
  - 0 degrees for yellow and violet,
  - 105 degrees for Magenta and Green,
  - 165 for Orange and Cyan and
  - 45 for Black

Screening angles

Dryback Results Old Formulation vs New Formulation

Density stability of the press runs

DE00 Comparisons EG build vs. CMYK build
DE00 Comparison Esko EG build vs. CMYK build

Pantone 109 - Similar DE00 - Slightly Different Composition

Pantone 201 - similar composition yet different DE00

Pantone 355 – Esko 4-color composition and successful alternative composition

Pantone 364 - Slightly Different Compositions
Colors with a lower DE00 than the 4c composition

- P201
- P286
- P2745
- P2685
- P364

Colors with a lower DE00 in their 4color composition

- P116
- P300
- P485
- P527
- P7692

Color gamut of the test patch charts

Color gamut with the test colors

Color gamut with the test colors (video)
Possible reasons for the observed color differences

- Solid ink density differences between the press run of the calibration patches and the press run of the test form
- Color differences in the process colors between the two press runs
- Tone value increase differences between the same press run

Possible reasons for the observed color differences

<table>
<thead>
<tr>
<th>Color</th>
<th>Ink density difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
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<tr>
<td>Cyan</td>
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<tr>
<td>Magenta</td>
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<tr>
<td>Yellow</td>
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<tr>
<td>Violet</td>
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</tr>
<tr>
<td>Green</td>
<td>0.03</td>
</tr>
<tr>
<td>Orange</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Significant density differences in black, cyan and violet

DE00 color differences between the Pantone data and the measured colors

Pantone color formulations

Color differences in DE00 between test run and Pantone color press run
Printing a seven-color job on a four-color press is not without its challenges.

- Tight control of the ink densities is very important to minimize printed color differences.
- Unknowingly we chose colors that were at the edge of the color gamut of the inks used in this project.
- We learned a lot about screen angles, test charts, expanded gamut printing.

Acknowledgements

- We are grateful to GMG North America for donating their OpenColor software and Esko for the donation of the required software applications.
- Our thanks go also to Birgit Plautz and her team from GMG and Julian Fernandez from Esko for their input during the project.
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